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for "engineers" that does not use the calculus. It was well enough in the early days to "work up" in the profession, to apply from a hand-book formulas about the derivation of which he was ignorant. But at the present time engineering is supposed to be a learned profession, and the engineer who is unacquainted with calculus can hardly be said to be up to date. But on the whole this book ought to prove an excellent work for beginning classes in mechanics, for extension courses, for trade and manual training schools, and for those who do not understand the calculus or prefer not to use it.

The following correction is noted at the suggestion of the author. The line near the middle of page 55 should read as follows: "Now, if the values of W, a, b, and c are known, and $a = b$, then".

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Elements of Analytic Geometry. By A. ZIWET, Professor of Mathematics, University of Michigan, and A. D. HOPKINS, Instructor in Mathematics, University of Michigan. New York, The Macmillan Company, 1916. vi + 280 pages.

The present edition of this Analytic Geometry is a reproduction of the earlier book by the same authors[1] with the omission of those parts concerned chiefly with college algebra. The reason given for the abridged edition is that college algebra is usually taught previously to, and independent of analytic geometry.

Thus, in discussing the intersection of two straight lines, the determinant form of the solution is retained, but the development of the determinant is omitted.

The algebraic treatment of simultaneous equations, determinants, permutations and combinations, complex numbers and theory of algebraic equations, including numerical equations is omitted.

The part on the plane now occupies 180 pages. The part on three dimensions is almost exactly as before, and occupies 75 pages. As the parts retained have not been altered, the comments made on the previous book apply to this one.

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Differential and Integral Calculus. By CLYDE E. LOVE. The Macmillan Co., New York, 1916. xviii + 343 pages. $2.10.

The first impression made by a book is physical; with this text that impression is most agreeable. The 339 5 x 8 inch pages of excellent typography give the impression of skillful brevity. A careful examination shows that none of the topics of the traditional American text is omitted and that after all the book is of about the usual length. In fact the preface lays no claim to brevity or any other sort of novelty. It is clearly a book well tested before publication, bearing

[1] *Analytic Geometry and Principles of Algebra*, 1913. Reviewed in this MONTHLY, Vol. xxi, pp. 85–89.

no marks of an author's idiosyncrasies. There is no suggestion of anything but a standard treatment of a well-delimited mathematical subject. No applications outside of geometry and mechanics appear, and since in these fields the problems deal extensively with interesting but unnatural curves and with material points having mass but no volume it is questionable whether an ordinary student will discover any applications at all.

The topics are well arranged. Differentiation has numerous applications before transcendental functions are taken up. A moderate treatment of integration (culminating in integration by parts and rational fractions) is followed by all sorts of problems in single integration except fluid pressure. There is then a return to the differential calculus for Taylor's Series and partial differentiation. Then come multiple integrals, with fluid pressure in a chapter by itself. A good introduction to differential equations, some kinematical applications, and an index close the book.

Under maxima and minima (p. 41) problems 26–32 seem to be new, and there is a bit of graphical differentiation on p. 43 which is out of the ordinary. But in the main the standard problems and the standard methods of varying them have been used.

Some features which the reviewer enjoyed were: the arrow notation for limits, the avoidance of the too explicit formulas for summation (for instance $\pi\int r^2\cdot dh$ is given for a volume of revolution rather than $\pi\int y^2\cdot dx$, exceptional cases given among the problems on the too obvious Rolle's Theorem, the use of the steel spring instead of a sinusoidal formula in illustrating a type of limit, and the honesty of the admission of the reason for taking up triple integrals. The use of the phrases "arbitrarily close approximation" (p. 151), "expand about the point $x = a$" (p. 223), "cross derivatives" (p. 238) is to be commended. The reviewer hopes that Osgood's adjective "respectable" as applied to functions, and Kowaleski's "almost all" ("fast alle") may next be admitted to the dignified currency which such a textbook confirms.

De minimis non curat lex, but trifles furnish much of his opportunity to the reviewer.

Fault may be found with the statement (p. 51) about the meaning of arc sin x, according to which we must infer that the area under $y^2(1 - x^2)$ from $x = 0$ to $x = 1$ is the *angle* $\pi/2$ radians. Surely in the calculus arc sin means a *number* (of radians in the angle), not the *angle* itself (however measured).

On page 59 the important fact that $e = 2.718 +$ is predicted but it is justified only in an exercise to be solved by the student later (on page 230). On page 228 the limiting behavior of the important function $x^n/n!$ is obscurely disposed of by reference to an exercise seven pages earlier.

No reason is given for adopting the notation dy/dx (p. 14) nor is the student warned against the false interpretation of dy and dx which he inevitably adopts here. Again no reason is assigned for introducing differentials (p. 68) in chapter 6; no use is made of thcm until chapter 11 and then only on the plea (p. 116) that reasons will appear later. As a matter of fact the reasons do appear on

pages 122 and 150, and the reviewer thinks that there should be this definite reference forward on pages 68 and 116.

All the expansions are to infinite series; the familiar approximations for reciprocals, logarithms, roots, etc., so useful in computing, are nowhere given.

In dealing with variables, limits, and infinitesimals, there is nowhere shown an actual variable in the modern sense, a succession of numerical values; the ordinary student thinks that constants enjoy a monopoly of the Arabic notation, variables requiring always to be *spelled* in letters.

Perry says, in his *Calculus for Engineers*, that the only integrals needed outside of pure theory are $\int x^n \cdot dx$, $\int dx/x$, and $\int e^x \cdot \sin x \cdot dx$. The latter does not appear in this text. Hyperbolic functions appear on page 64 and disappear on page 65, leaving no applications behind.

The proof (p. 123) that we may make a substitution before integrating will seem unnecessary to students just as it does later (p. 267 and p. 272) to the author himself.

"A feature of the book is its insistence on the importance of checking the results of exercises." In every respect but this the text seems to bear out the claims set up in the preface. The reviewer found no attention given to the general question of checking, and except under double integration (where more than one order of work is often possible) very few problems call for solutions in two ways. Moreover, the book omits a great many answers in places where a printed answer is the only reliable check a student can get. No rough methods of checking are suggested, such as sketching derivative or integral curves or other graphical devices, nor is there any hint of checking limits by computing neighboring values, nor of checking differentials by computing small increments, nor of checking integrals by Simpson's rule.

A few criticisms which might equally well be made of other texts beside the one under review are: the absence of any but abstract exercises in indeterminate forms, the failure to illustrate the important formula

$$\frac{df(x, y)}{dv} = \frac{\partial f}{\partial x}\frac{dx}{dv} + \frac{\partial f}{\partial y}\frac{dy}{dv},$$

so that the student can realize that it is good for anything or even recognize it when he meets it in physics, the retention of the phrase "total pressure" for the force on a plane area, and the pretense that *infinite series* are used in computation. The reviewer contends that it is approximation formulas that are used in computation, infinite series being used only in analysis.

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